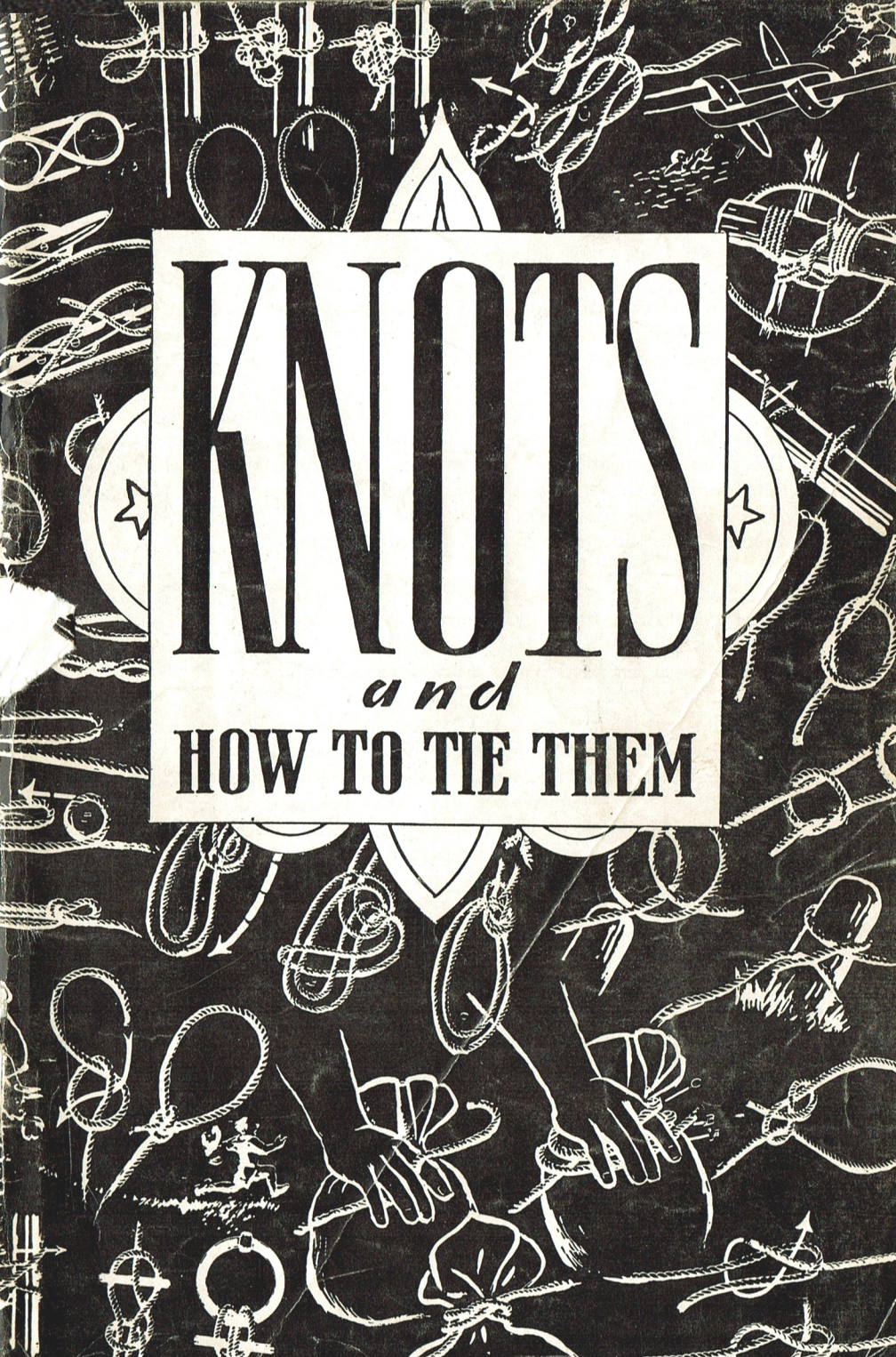
KNOTS
and
HOW TO TIE THEM

Foreword

We present this volume in response to the insistent demands that have come from the field for a comprehensive, simple book of ropework used by Scouts.

The Editorial Service has made a thorough study of all suggestions that have come into the National Office for many years and of the printed literature on the subject. Authorities have been called into conference to plan the pamphlet and to correct or to suggest changes in the final manuscript and diagrams. An effort has been made to co-ordinate all of our knot information.

For the sake of brevity the selection of knots has been limited to those generally useful, and where there are several specialized methods of tying a knot, we have selected the one that is most adaptable or that gives the best structural understanding.

Although there is no substitute for personal instruction by an experienced teacher, we feel that this compact volume on knots will perform a real service. Scouts who wish to make themselves thoroughly competent in ropework will have this material in practical, convenient form. We commend it as a clear, authoritative, and lively reference for all those who are interested in the development of skill in the use of knots, splices, and lashings.

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Knots

And How to Tie Them

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The Story of Knots

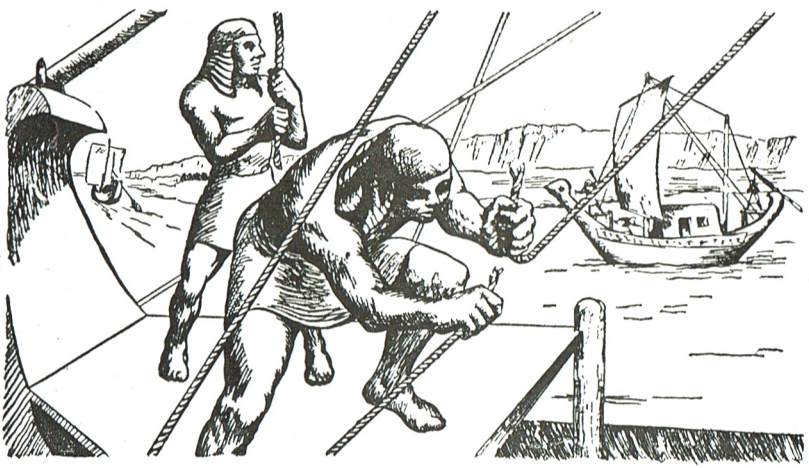
Thousands of years ago Og, Son of Fire, or some one of his fellow prehistoric men, tied the first knot. No historian was on hand when this distant ancestor of ours discovered that by twisting together the ends of vines or withes he could use them to connect and to bind. But the knot he tied was undoubtedly the one we call the overhand knot today. From this start he had only a short step to the invention of a second fundamental knot—the knot now known as the figure-of-eight knot. Passed down from primitive ancestors, the overhand and figure-of-eight knots were used by the early American Indians to tie the thongs that bound the stone heads to the shafts of their hammers, axes, and arrows.

As ages passed and man's knowledge and intelligence expanded, his needs and contrivances gradually grew more complex. As he learned to weave, build, and farm he created many new knots to do more complicated tasks. Probably the square knot was one of the first of these, followed by the closely related carrick bend and weaver's

knot. Authorities do not know the exact order of the invention and development of later types. Such basic knots as the slipknot and the half hitch, however, must have been early discoveries.

With the rise of civilization in Africa, Asia, and South America began the traceable record of man's ever increasing uses of knots. The Egyptian boatmen who plied the Nile were experts at tying knots; knots were used in ropes that fastened the doors on tombs of pharaohs and noblemen; and the square knot was a popular decorative motif in Egyptian jewelry of 5,000 years ago. With travel and exploration so limited as to make their land almost a separate planet, the Incas of Peru developed a complex system of knots at about the same time as Egypt. In China, the oldest civilization of all, knots have been used since earliest times. The Chinese devised a method for counting with the aid of knots in a string. Today sheep herders in the widely separated countries of China and Peru use a similar system for tallying their sheep by means of a knotted string.

Many of our modern knots were in use among the Greeks and Romans, and their forms have been preserved in decorative jewelry and sculpture. From the Greeks also comes the most famous of all legends concerning knots—the Legend of the Gordian Knot. Gordius, king of the Asiatic land of Phrygia, devised a knot of such marvelous complexity that it was prophesied that whoever could untie the Gordian knot would become lord and ruler of all Asia. Many men



tried, but all failed until Alexander the Great came to Phrygia. Alexander probed and pulled without success. Angry and impatient, he slashed the knot in half with his sword.

But the Gordian knot was only one of many knots that came to be regarded as endowed with mystic properties. For centuries superstitious men looked upon many common types of knots as having supernatural powers. To the Greeks and Romans certain knots were supposed to bring good or bad luck. In medieval times witches and wizards conjured spells with knots and sold charms made of knots. These charms could supposedly bring good or evil to the wearer, control the weather, or improve the health of those who knew how to tie them. Before the invention of buttons, knots were used to fasten clothing. Many people believed that if these knots were cursed by a witch, disaster would fall unless the curse were removed by a priest's blessing upon the same knots.

The influence of such superstitions lingers even today. In the early days of mariners, the knot that tied a sailor's neckerchief about his throat was considered a symbol of good luck. Although its meaning has long been forgotten, the same knot is used today in tying an everyday four-in-hand necktie.

The Development of Rope

Although we automatically associate knots with rope, thousands of years may have elapsed between the discovery of the elementary knots and the invention of rope. For a long while primitive man was satisfied with such crude but easily obtainable materials as vines, reeds, and leather thongs. Rope probably developed from the thongs. A single thong was found too weak for some purposes, and so two or three thongs had to be combined. To twist the leather strips into a solid rope was a short and natural step.

As man's materials expanded beyond stone, leather, and wood his ropes grew lighter and stronger. When the first crude cloth was woven from wool, the same yarn was made into string and rope. Later the Egyptian sailors formed tougher ropes from the papyrus and flax that grew on the banks of the Nile. The cotton and sisal of Central America, the jute of India, and the manila fiber (often mistakenly called hemp) of the South Sea Islands were also found to make stronger and more durable ropes. In the last few years nylon has been used in making both twisted and braided rope. Nylon is stronger and less liable to deteriorate than other materials. It is, however, affected by extreme heat and is rather elastic, a quality that may be good or bad depending upon what the rope is to be used for.

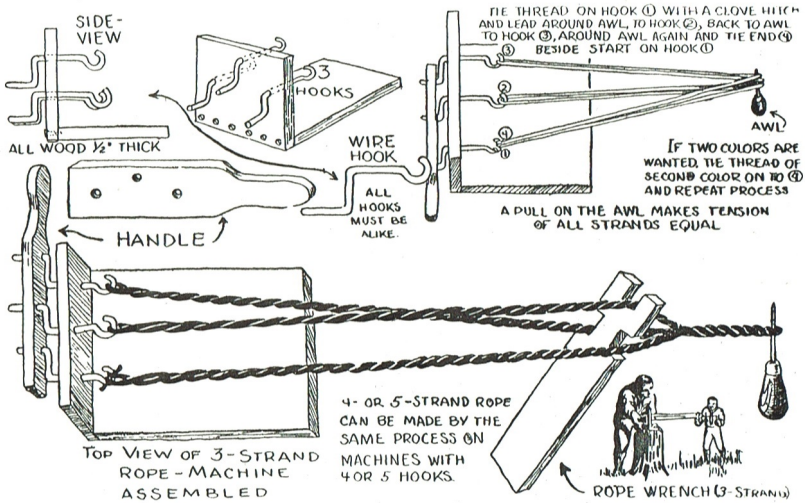
With the improvement in materials and methods came improvement in the technique of making rope; and the two present methods, twisting and braiding, slowly evolved. In a twisted rope a few fibers are twisted to the right to form a yarn, then a few yarns are twisted to the left to form a strand. Three (or sometimes four) strands are twisted to the right to form a rope. Three ropes are twisted to the left to form a large cable-laid rope.

The important element in twisted rope is the alternation of directions so that the fibers and strands pull against each other and overcome their natural tendency to untwist and fray. The friction of the alternately twisted parts makes a hard compact rope, capable of repelling water and standing tremendous strains.

The braided type of rope is usually woven by a special braiding machine in much the same manner as are heavy fabrics. When made this way good cotton rope, such as "spotted cord," is smooth, compact, and capable of giving long service before it becomes too soft. One way to test the quality of sash cord is to moisten it. The sizing in poor grades will quickly make it pasty and sticky. Braided rope is used extensively for rope spinning.

Braided rope is rarely made larger than one inch in circumference, and twisted ropes and hawsers are seldom less than one inch in circumference. (Remember, however, that rope sizes are usually indicated by diameter.)

Try Your Hand


SIDE-VIEW
3 HOOKS
ALL WOOD ½" THICK
WIRE HOOK
ALL HOOKS MUST BE ALIKE.
HANDLE
TIE THREAD ON HOOK ① WITH A CLOVE HITCH AND LEAD AROUND AWL, TO HOOK ②, BACK TO AWL TO HOOK ③, AROUND AWL AGAIN AND TIE END ④ BESIDE START ON HOOK ①
AWL
IF TWO COLORS ARE WANTED, TIE THREAD OF SECOND COLOR ON TO ④ AND REPEAT PROCESS
A PULL ON THE AWL MAKES TENSION OF ALL STRANDS EQUAL
TOP VIEW OF 3-STRAND ROPE-MACHINE ASSEMBLED
4- OR 5-STRAND ROPE CAN BE MADE BY THE SAME PROCESS ON MACHINES WITH 4 OR 5 HOOKS.
ROPE WRENCH (3-STRAND)

MAKING ROPE

You might like to try your hand at making rope, using the method pictured above. Rotate the handle with one hand, holding the rope wrench with the other hand, using it as a divider to keep the strands apart. After considerable practice you may be able to produce something comparable to the rope that is now turned out by modern machines. In the days of clipper ships, and even before, all rope was made by hand in long yards known as "ropewalks." The spinners were highly skilled craftsmen.

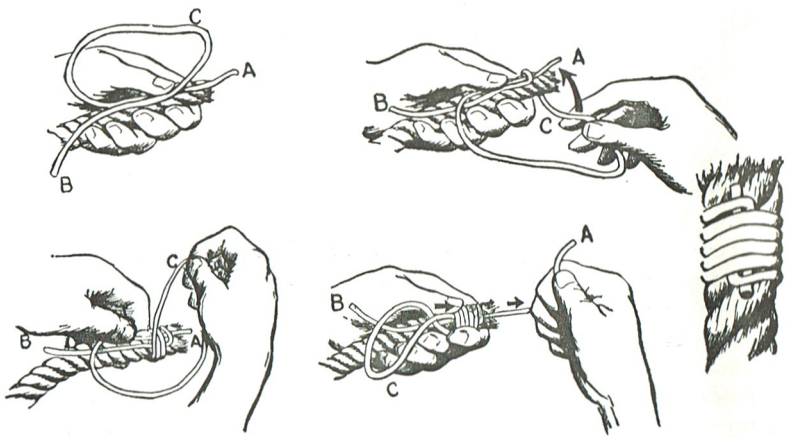
PREPARING YOUR ROPE

With the foregoing facts about knots and rope in mind, you are ready to learn how to handle, tie, and use rope. Obtain a piece of rope about an inch in circumference (that is, 5/16 of an inch in diameter) and about twenty feet long. A short piece is of little or no practical use. Because you are going to use this rope for a long time as a part of your regular equipment, treat it carefully and prepare it for hard service.

One important preparation is the protection of the rope ends against wear. Unless protected, the twisted strands will loosen and fray at the ends. A figure-of-eight knot at each end will serve as a temporary stop but should not be left permanently. As soon as possible the ends should be treated in one of the two following methods:

Whipping

There are many ways of whipping a rope end, but in all of them the principle is the same—to make the whipping snug and smooth by jamming its ends tightly underneath its windings. Sometimes a loop of the whipping material or of another piece of twine is used to pull the ends under. Sometimes a needle is used, especially by sailors, to draw the free end under and to fasten it with stitches through the rope. The system described here is simple and will give a tight whipping without bulky loops. It can be made more secure by burying end B underneath a strand of the rope before starting.



Begin by laying a loop of the whipping material on the end of the rope as shown in the first drawing. End B can be any length, but end A should be fairly short. Turn the body of the loop C over the end A at a right angle and take several turns around the end of the rope, spiraling away from the end and drawing each turn very tight. In wrapping, keep half of the whipping loop held beyond the rope end so that it does not wind double. When the whipping is as wide as the diameter of the rope, pull on end A until the loop has disappeared. If you have made the turns tight enough this should take quite a little strength. Finally, trim off ends A and B. A snug whipping like that shown in the final drawing should result.

Back Splice

A more permanent and satisfactory method, except when a lump on the end would hamper use of the rope, is to back splice each end (see page 47). When you have learned this intricate process you will have a skill of which you can be proud.

WORKING YOUR ROPE

If your rope is of the cotton-braided variety it will quickly become soft and pliable. But it will grow more so with use and handling until finally the rope will be so rubbery that it will be of little use for knot tying.

A manila rope is the best for almost all purposes except hanging out wash and is the type recommended for general use. When you buy it you will find it somewhat tough and stiff depending on how "hard" (tight) the lay is. You may be annoyed by the rope's tendency to kink, and it is likely to leave fine slivers of fiber in your fingers. The latter can be prevented by running a piece of coarse cloth over the entire length a number of times. A hard-laid rope is not good until it has been thoroughly worked and has been made reasonably soft and pliable. If you were in a cow camp and could see a cowboy breaking a new rope you would realize what an ordeal the process is.

To soften a new rope, the cowpunchers will spend hours working the rope—pulling it, stretching it, and twisting it to take out the stiffness. Eventually they get it worked out to their satisfaction and convert it into a "lass line." It would take a good many dollars to make a cowboy part with a well-worked rope.

HANDLE WITH CARE

A good rope is never cut unless absolutely necessary. Cowboys, sailors, farmers, riggers, and all men who work with good rope know it well and value it highly. They consider it a possession to be cared for and to be treated with respect until it is thoroughly worn out. A Boy Scout who possesses a good rope should have the same sense of pride and appreciation.

You must treat your rope as if it were a living thing. In return for care and consideration, it will give you long and faithful service. If it is damp do not coil or store it until it has been thoroughly dried in the sun. Always keep it in a dry place.

Rope that is not in use should never be thrown in a corner to tangle and kink. When a job is finished, the rope should be placed where it will be available instantly if necessary and should be coiled so that it will pay out smoothly.

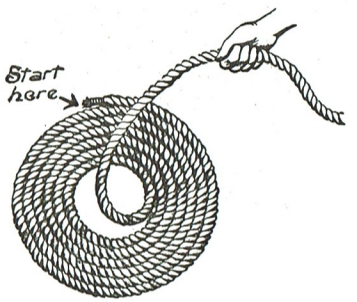
HANGING COIL

To coil a twisted rope for hanging on a peg, remember that experts never coil a rope by merely picking up one end and looping it over and over, allowing each loop to dangle from the hand. Nor do they, like the washerwoman, coil the rope from hand over crooked elbow. (A braided rope or an electric cord, however, is coiled in a figure-of-eight pattern, sometimes about the arm or over a holder, to prevent kinking.)

Study the cowboy, sailor, or rigger as he coils a twisted rope and you will discover that every loop he forms is about eighteen inches in the long dimension and that one loop is laid on top of the other with care and neatness. Before starting a coil, one of these experts shakes out the rope along the ground in as straight a line as possible so that there will be no kinks in it. He then holds one end in his left hand and, reaching forward with his right, gathers sufficient rope to make a loop. As he places this loop over the palm of his flatly extended left hand he rolls the rope between thumb and forefinger of his right hand, giving it about a half turn towards his body. This half turn counteracts the twist put in the rope as he looped it and prevents kinks from forming. This turn is extremely important when, as in throwing a lariat or a life line, the rope must travel through the air straight and true.

FLAT COIL

On shipboard, and especially in the Navy, all ropes not in use are looked after carefully. For a short length of rope one of the neatest methods employed by the sailor is the flat coil (sometimes called deck coil). Many beginners start this coil backwards. Correctly done, the coil is begun by laying the outer circle first and winding inward in a clockwise direction. The mat can be wound loosely and then tightened by twisting the center with the palm of the hand. As in all coiling, you must guard against kinks by giving a half turn to the rope as each loop is laid. A flat coil may take several tries before you can estimate accurately the exact size of the first circle in order to coil all the rope flat.



Flat Coil

LONG COIL

Although the flat coil is impractical for ropes of any great length, its basic principles apply to the coiling of any amount of rope. When a long rope must be coiled in several layers, an outer wall is coiled first and the inside filled by successive vertical windings. This coil cannot be made as neat and precise as the flat coil, but requires the same clockwise direction and the half turn to prevent kinking.

UNCOILING

Remember that in paying out rope from all of these coils the correct procedure is to begin with the end in the center of the coil. Bales of new rope or balls of twine should also be unwound from the inside and in a counterclockwise direction. (If the rope uncoils clockwise, the end should be pushed through the center of the coil and paid out from the opposite side.)

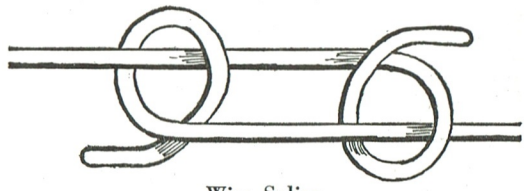
Materials

A few knots are purely decorative, but the vast majority of them serve some practical function. Although we usually associate knots with rope or twine, we must remember that rawhide thongs, straps, gut, wire, fishline, hawsers, neckerchiefs, and dozens of other flexible materials often must be fastened by knots.

Bandages: The use of knots in bandages, tourniquets, and other first aid measures is an application often underrated in importance. Such work demands skillful tying so that the first aid will be swift and sure, even under difficult conditions, and so that the bandage can be easily untied or loosened if necessary.

Vines: Today, in the north woods, trappers and woodsmen still use vines for tying together small packages or for suspending a canoe out of reach of gnawing animals. These vines, however, can only be used during the warm months, when they are green and pliable.

Bark: Good rope may be made from the inside bark of willow, basswood, elm, mulberry, tulip, or hickory trees. (See *Boy Scout Handbook.*)

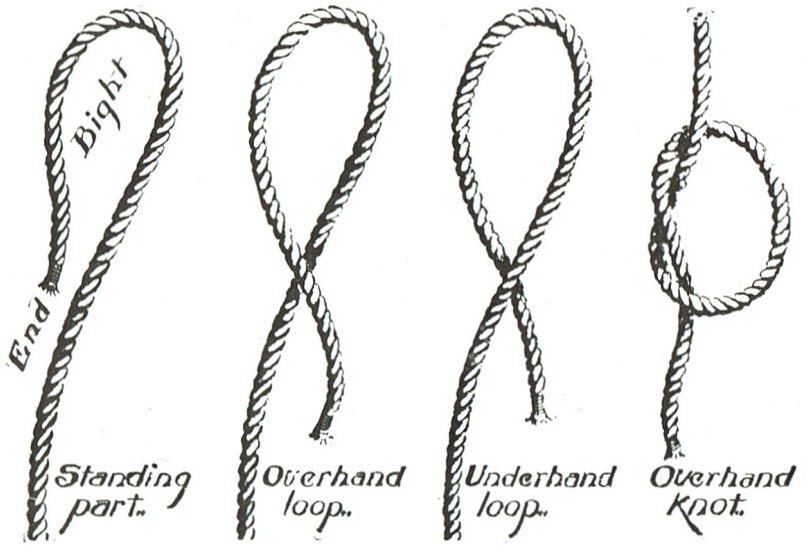


Wire Splice

Wire: Galvanized wire is in wide use at the present time. It is too stiff to form knots without use of instruments, but it is so common that everyone should know the simple wire splice shown.

Hawsers: Hawsers are large manila ropes used principally in towing or in mooring large ships. Today smaller steel wire hawsers often replace the fiber ones.

First Steps



BIGHT, LOOP, AND OVERHAND

A straight piece of rope does not have definite parts such as a head, body, or tail. But in order to understand and describe knot tying, we think of it as having three sections—two ends and a standing part. Some knots are formed by two ends (square knot), some by the end and the standing part (bowline), and some by the standing part alone (sheepshank, man-harness knot).

Many knots seem an endless maze of parts. But even the most complex knot can be broken down to a combination of three basic turns—bight, loop, or overhand.

End Knots

Overhand Knot

Figure-of-Eight Knot

Stevedore's Knot

OVERHAND KNOT

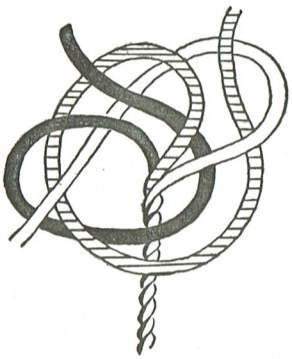
The overhand is the simplest of the end knots. Like the others of this group it is most often used to prevent slipping. Tied in the end or standing part of a rope, these knots check it from sliding through a block, hole, or part of another knot. They may also be used as a temporary stop to fraying (see page 8).

FIGURE-OF-EIGHT KNOT

Slightly larger and more involved than the overhand, the figure-of-eight is more frequently used in such places as the end of the string when tying a package with a slipknot or in the end of a rope forming a lariat loop. Note that when snugged, the end of the rope projects at a right angle to the standing part.

STEVEDORE'S KNOT

This knot differs from the figure-of-eight only in the extra turn and the resulting larger size and chain-like appearance. It has the same uses as the other end knots. Farmers sometimes tie it, with a toggle (see page 41) inserted, at the end of a hay rope.



WALL AND MATTHEW WALKER KNOTS

The wall knot, the single Matthew Walker knot, and the double Matthew Walker knot are three forms of firm, round, semipermanent "stopper knots" tied with the end strands of a rope.

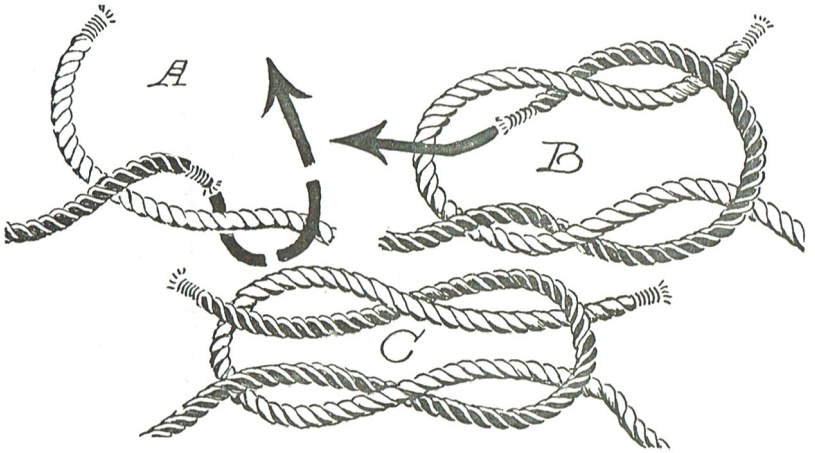
The wall knot (A) at first looks like the crown knot used to start the back splice (see page 47), but notice that in the wall knot the ends come up through the bights, causing the strands to lead forward. In a crown knot the ends go down through the bights and point backward.

The single Matthew Walker knot (B) is the wall knot carried one step further. Begin it by tying a wall knot, and then, before snugging, carry each end through the bight ahead of it so that each strand runs under two bights.

The double Matthew Walker knot (shown finished in C) is made by the same process as the single, with the ends carried through the third bight (their own), so that it is three complexly interlocked overhand knots.

All of these knots must be snugged carefully, pulling on each strand separately and only a small distance at a time so that all three tighten evenly. When the knot is reasonably snug, pull on all three ends and work it smooth. Then the free ends can either be trimmed off fairly close or the strands can be twisted together again and whipped, as shown.

Binding Knots



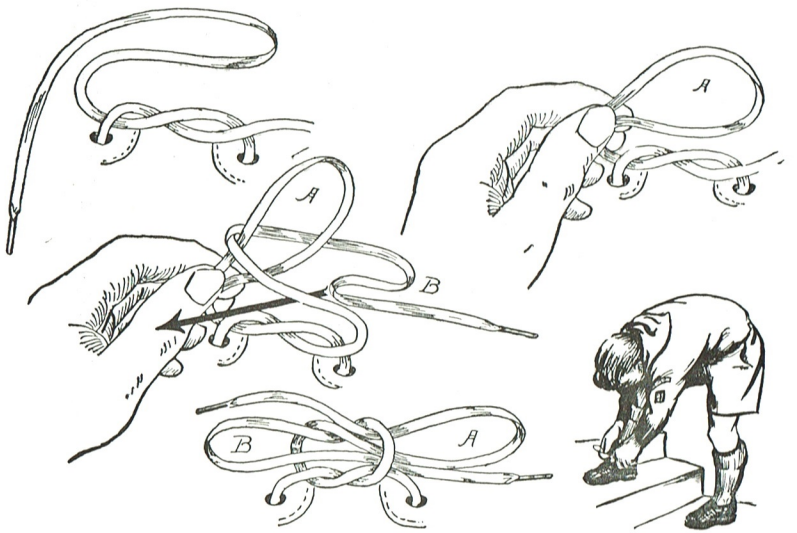
SQUARE KNOT

The square knot, sometimes called the reef knot, is used many times daily in every home, school, and profession. Because it ties and unties easily, yet holds firmly, it is the most important of all first aid knots. Unless made carefully, attempts to tie a square knot are apt to end with the relatively useless granny knot, which either slips or jams, in the latter case being hard to untie. Notice that in the square knot the end and standing part of one rope come out on the same side of the bight formed by the other rope. In the granny knot the end and standing part are on opposite sides.

Tying: The square knot is begun with an over and under (or under and over) crossing (Fig. A), and the ends are then brought back above in a second similar crossing (Fig. B). The completed knot (Fig. C) is snugged by pulling on the ends. Note that it makes no difference whether the first crossing is tied left-over-right or right-over-left, as long as the second crossing corresponds to it correctly.

A square knot can be loosened easily by taking an end and a standing part of one rope in each hand and pushing the bights apart. A square knot can also be loosened by pulling the end and standing part of one rope in opposite directions. The strained rope will straighten, leaving the second rope wound about it in a lark's-head (see page 41). The latter fact makes the square knot poorly suited to tying packages and dangerous to use for joining ropes or life lines.

SHOESTRING TIE



Strange as it may seem, there are a great number of people who improperly tie the lacings of their shoes. The shoestring bowknot is technically a square knot with both ends "slippery."

Tying: To start, use a simple crossover of both laces, as shown in the upper left-hand picture. With the thumb and forefinger of the left hand grasp the loop A as shown in the second drawing. With the right hand take the other lace around the loop A and form a bight shown as B. Bring the bight back in the direction of the arrow. A tie like the drawing shown at the bottom will result. This knot will not become undone easily if the two loops A and B are grasped and pulled tight in opposite directions.

SURGEON'S KNOT

The surgeon's knot differs from the square knot by having the left end taken around the right end twice instead of once on the first crossing. (See illustration.) The doubled first crossing gives enough friction to hold until the second can be tied. (Sometimes the second is doubled, too.) This quality makes it especially valuable to doctors performing operations, hence its name.

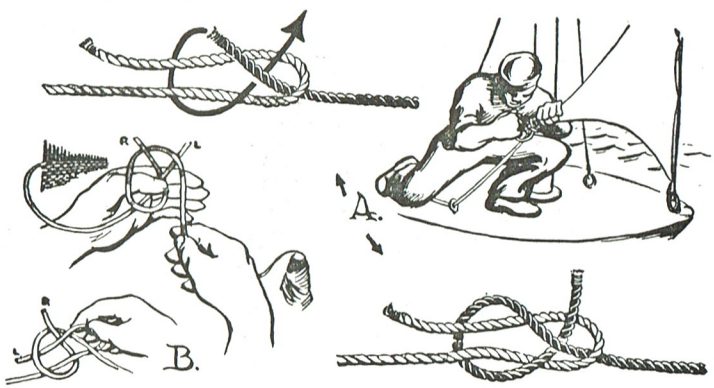
Knots for Joining Rope Ends

SHEET BEND (WEAVER'S KNOT)

The sheet bend is the most important knot for joining two rope ends and is especially useful when the ropes are of unequal size. A permanent loop—tied, seized, or spliced—can be substituted for the right-hand portion of the knot.

"Sheet" is the name given to a number of the ropes that go to rig a ship. From its use in "bending" (tying) these, the sheet bend derives its name. The weaver's knot (B) is essentially the same as the sheet bend, but it is tied by a special method which is not practical for tying to permanent loops. When used to tie two rope ends or strands, however, the weaver's-knot method guarantees that the ends will emerge on the same side, thereby giving a sturdier knot.

Tying: The sheet-bend method (A) is to form a bight in the left-hand rope and weave the end of the right-hand rope up through the eye, around the bight, and back under itself as shown. The weaver's-knot method (B) is to lay the left-hand strand across and on top of the right-hand. Then carry the right-hand standing part up to the left in front of the left-hand rope and loop it around behind its own end (R). The knot is completed by pushing the left-hand end back parallel to its standing part. When ropes of different sizes are tied



with the weaver's method, hold the larger one in the left hand. Both the sheet bend and the weaver's knot should be snugged carefully before strain is applied.

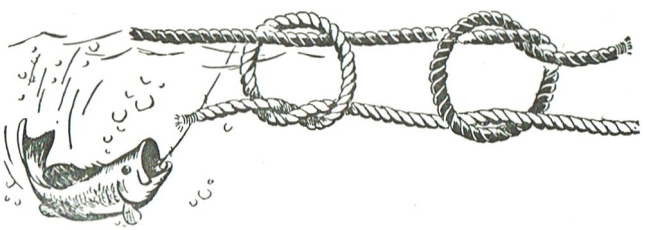
SLIPPERY SHEET BEND

The slippery sheet bend is invaluable when it is necessary to undo two ropes suddenly. Like a sheet bend, it will hold without slipping, but it can be untied completely by a tug on the free end.

This knot is a wise one to use on packages that require frequent opening and temporary ties. For the linking of guard ropes by Scouts it has no equal. Each Scout takes the end of his own rope and ties it with this knot to the rope of the next Scout. The lines will hold fast against the pressure of a crowd, and when the need for guarding is over, a mere pull on the knot and the crowd may come through.

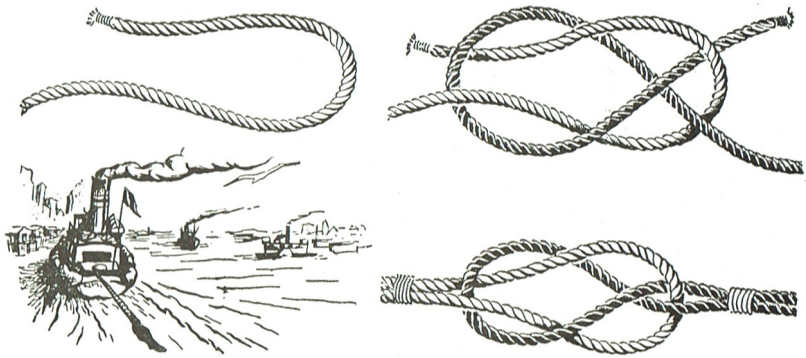
Tying: The slippery sheet bend is easily tied by either method with a bight in the end of the right-hand rope.

FISHERMAN'S KNOT



This knot is illustrated with a rope although it is most frequently employed to tie more difficult materials. Fishermen use it to join pieces of gut in forming leaders for their fishing lines. Because of synthetic gut that may be obtained in long lengths, this knot is disappearing from use among fishermen. It should be known, however, in order to repair broken leaders. Never tie it until the leader has been soaked and is flexible.

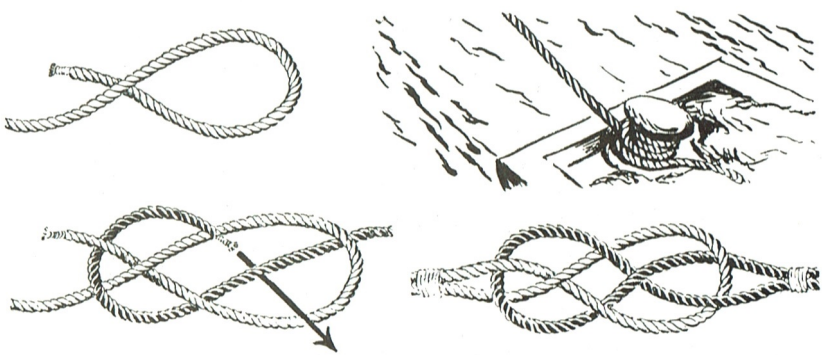
SINGLE AND DOUBLE CARRICK BENDS



Single Carrick Bend

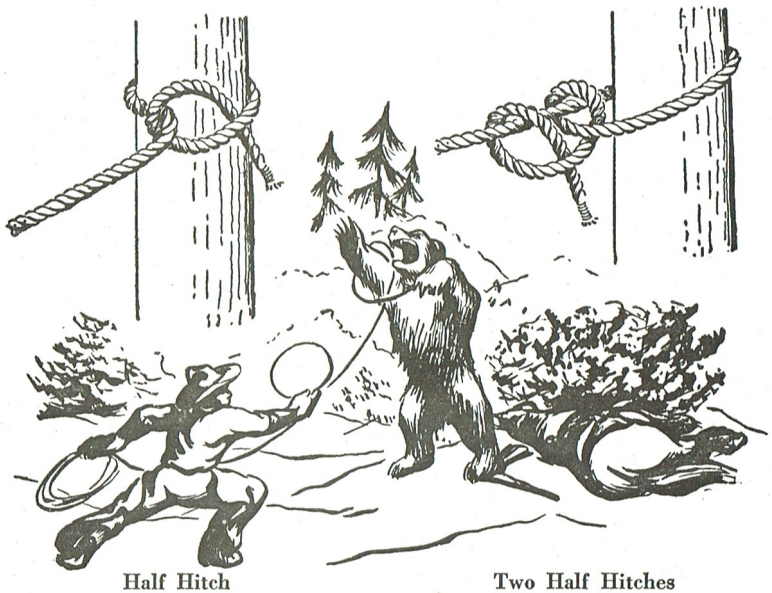
These knots are of little use to anyone who does not have to work with large ropes or hawsers, as in towing. They are never used unless both ends are seized (see pages 42-43) onto their standing parts. The single carrick is begun by forming a bight in the first rope. The double carrick is begun with an underhand loop. In the single carrick you will see only one crossover rope in a loop while in the double carrick you will see two.

Tying: The principle in tying both knots is the same. Start with either the bight or the loop (depending on which knot you are tying) and weave the end of the other rope around as shown in the illustration. After the seizing is finished put the strain slowly on both ends.



Double Carrick Bend

Knots for Tying Ropes to Objects



Half Hitch

Two Half Hitches

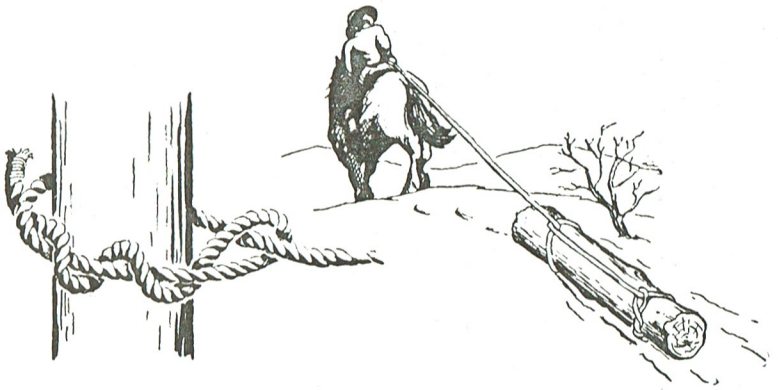
HALF HITCH

Half hitches are very important aids in wrapping and are the foundation of many knots. A half hitch is the start of a timber hitch, the guide in a pipe hitch, and the second loop in tying up a package. By itself it will hold against a steady pull on the standing part (as in illustration), especially if a stopper knot (stevedore's or figure-of-eight) is first put in the end.

In their roping and tying, the cowboys and sheriffs of the West have developed a spectacular way of using half hitches. After the lariat has caught an animal about the neck or one leg, the cowboy can stand at a distance and by a swift, forward movement of his arm, send half hitches rolling down his rope to bind the animal further.

TWO HALF HITCHES

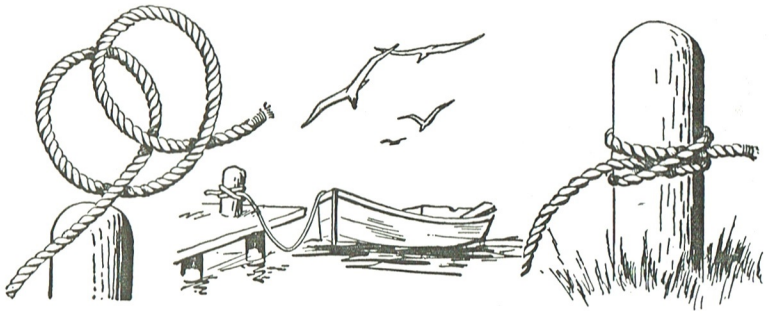
Here is a useful knot comparing favorably with the clove hitch. Care must be taken in finishing so that the rope runs to form what is really a clove hitch about the standing part. It may be used as a form of the packer's knot but is not as satisfactory.



TIMBER HITCH

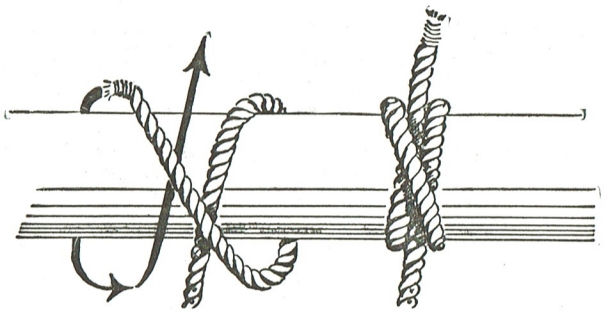
This is an important hitch. It will hold firmly and can be tied quickly. The diagonal lashing starts with it. In turning the rope back on itself care must be taken to see that the turns follow the lay of the rope. In towing a spar or similar object, a simple hitch should be added near the end of the object nearest the power for the purpose of guidance.

CLOVE HITCH



The clove hitch is one of the most widely used knots. Passing around an object in one continuous direction, it puts almost no strain on the fibers.

Tying: To tie a clove hitch over a post or any object which is open on one end, simply throw an underhand loop (hitch) and pull tight. Another underhand loop on top of the first will complete the knot. To finish, bring both loops close together and snug.

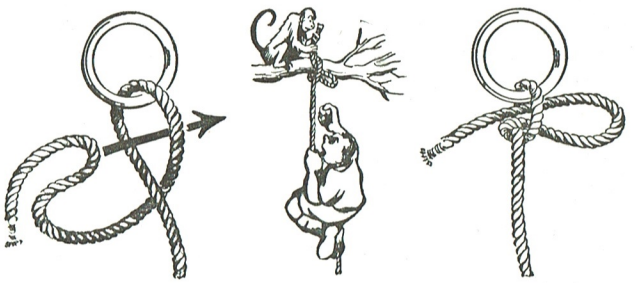


CLOVE HITCH OVER BAR

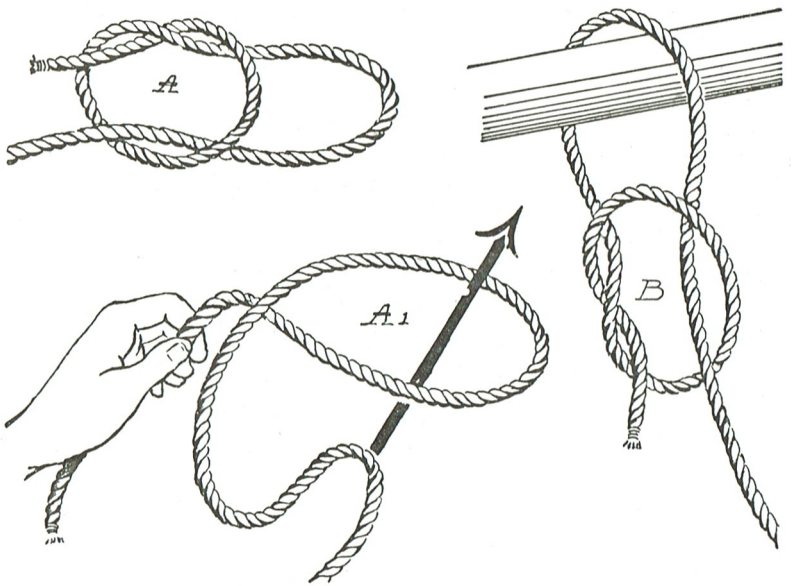
When it is necessary to form a clove hitch around a bar which is closed at both ends, or around a pole too high to toss over, the method is different. This hitch is used in starting most lashings and in finishing all of them.

Tying: Make a simple turn around the bar, cross the rope over and tuck it under as shown. The second figure shows the completed knot. The entire process may be reversed when occasion demands, bringing the crossover rope to the right instead of the left.

SLIPPERY HALF HITCH



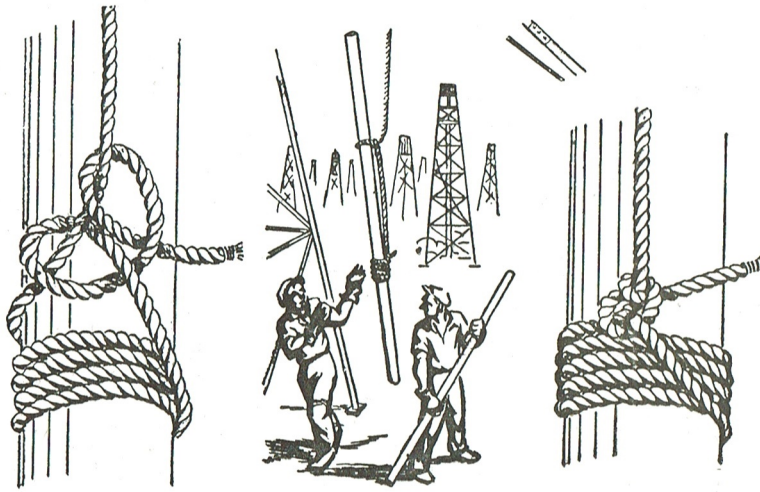
The slippery half hitch is a useful but temporary tie. In function and principle it resembles the slippery sheet bend, although the slippery sheet bend unites two ropes while the slippery half hitch involves only one rope fastened to a ring or other object. It should not be left alone because an animal can loosen it by simply pulling the end. It can be locked by passing the end down through the eye and pulling tight, as in the hitching tie.



SLIPKNOT

This knot is not as satisfactory as two half hitches because it takes longer to tie around an object that is closed at both ends and, unless stress is put on it, it is liable to slide on a vertical object. In tying a package the slipknot may be substituted for the packer's knot, but even with a stopper (figure-of-eight) knot in the end, it does not function as well. Its principle is found in such knots as the hitching tie, slippery half hitch, and the shoestring tie.

Tying: One thing is important in forming this knot with a rope. Grasp the rope at the end and tie the knot with the standing part as shown in Fig. A1. If the knot is tied with the end, the result will be a knot that has the same appearance but will pull through and become a plain overhand knot. To tie over a bar closed at both ends, throw the end over and tie an overhand around the standing part as shown in Fig. B.



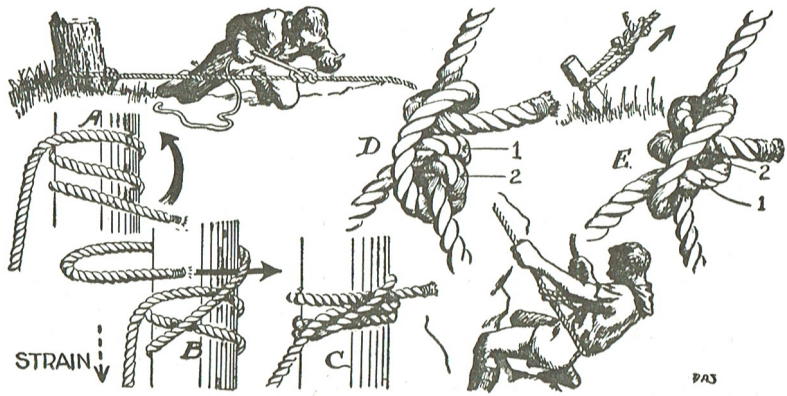
PIPE HITCH

This hitch, also known as the well-pipe hitch, is used almost exclusively for lifting pipe vertically. An added hitch is usually taken with the standing part, as in the timber hitch, around the upper end of the pipe to keep it in a vertical position.

Tying: Take four or five turns around the pipe as shown in the left-hand drawing, cross the end over and finish by tying two half hitches around the standing part. Before subjecting it to strain, see that the whole knot is snugged closely as shown in the right-hand drawing. Sometimes a running bowline is used instead of the half hitches.

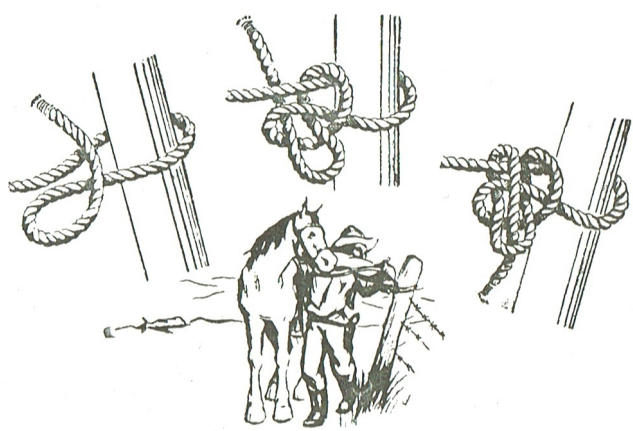
ROLLING OR TAUT-LINE HITCH AND STOPPER HITCH

Under a steady strain this useful modification of the clove hitch will not slip downward even on glass-smooth surfaces. Since it will slide only one way, the taut-line hitch is often used on tent ropes. This knot and the stopper hitch variation of it are also valuable in emergencies since they can be tied with one hand on a taut rope. With them a person can tie the free end of a rescue rope around his body or fasten a second rope to one about to break under strain.

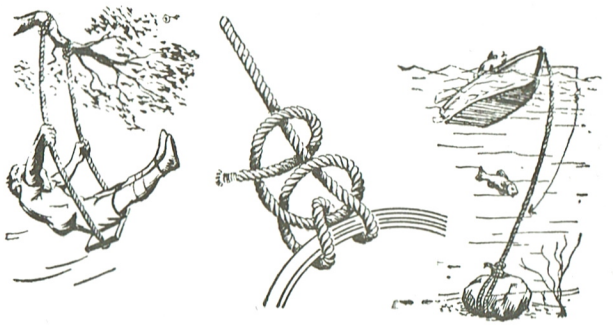


Tying: These knots are really clove hitches with an extra turn in the direction of the strain on the standing part. The rolling hitch (A, B, C) and the taut-line hitch (D) are tied in the same way and the stopper hitch (E) is formed by reversing turns 1 and 2. Be sure to snug the knot before submitting it to the full strain.

HITCHING TIE



Knots for hitching animals range from the popular hitching tie illustrated above to the unique method of tying the bowline ("Texas bowline") used by western and southern horsemen. In the hitching tie above, notice that the second move forms a type of slippery hitch (really a slippery slipknot, pulled into a slightly different form) until the end is brought down through the eye locking it.

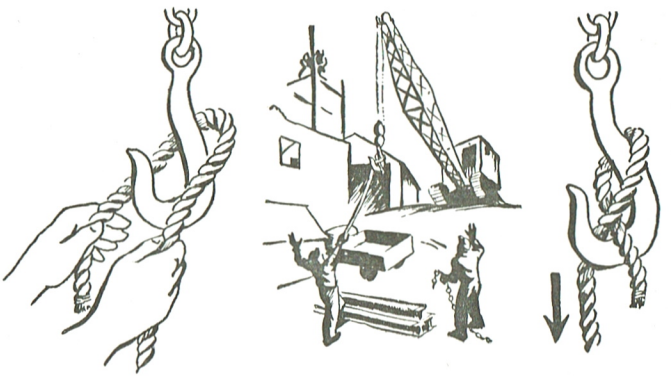


ANCHOR BEND OR FISHERMAN'S BEND

This knot is excellent for attaching a rope to a light anchor, a ring, or a rectangular piece of stone. It can be used to rig up a swing.

Tying: Take two turns through the ring or around the stone, bring the end over the standing part and through the loops (as shown). Finish as in two half hitches.

BLACKWALL HITCHES



Single Blackwall Hitch

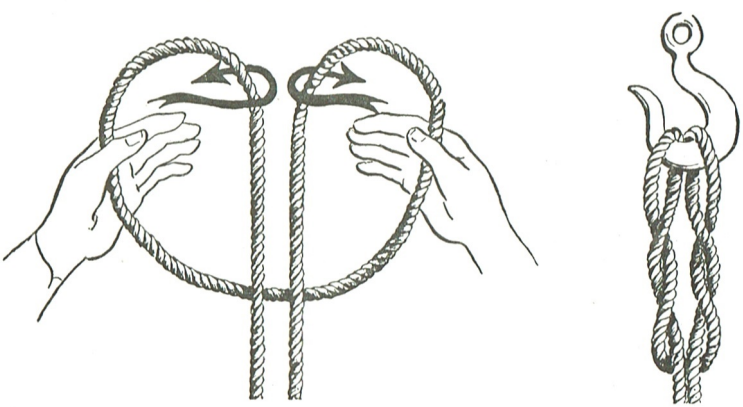
Human life should never be entrusted to the single and double blackwall hitches. They will hold only when subjected to a constant strain or when taken in the middle of a rope with both ends fast. A stopper knot in the end increases their security somewhat. They are generally used to attach a rope temporarily to a hook or similar object in derrick work. The single blackwall is an ordinary half hitch and is not as secure as the double.

Double Blackwall Hitch

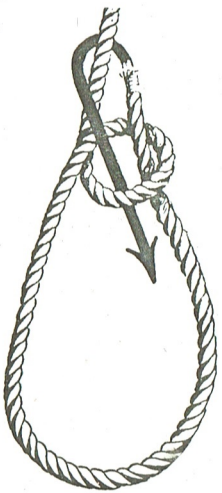
CAT'S-PAW

This knot, which is really a form of hitch, is a more satisfactory way of attaching a rope to a hook than either of the blackwall hitches. It will not slip off and needs no constant strain upon it to make it hold.

Tying: Form two loops as in the larger drawing. Turn these loops inward for one or two complete turns and hang the eyes so formed over the hook or object of attachment.



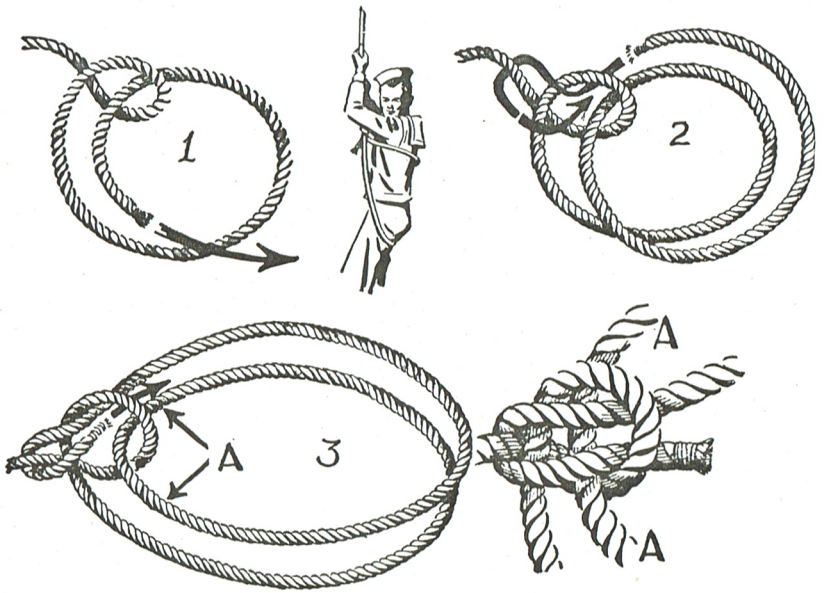
Knots for Fixed Loops



BOWLINE

A very important knot, the bowline forms a loop that will not slip or jam no matter how great the strain. In its many adaptations it is useful in first aid and lifesaving. There are several ways of tying this knot. The sailor uses one method on board ship. As a hitching tie, the horseman of the west and south ties it in another way called the "Texas bowline." The average landsman ties it in the somewhat simpler manner shown here. A thorough understanding of the several variations of this knot will be of great value to every user of a rope whether ashore or afloat.

Tying: Start by forming an overhand loop in the standing part, spaced so as to make the resulting loop large enough for its purpose. The free end is taken up through the eye, around the standing part, and right back where it came from.



FRENCH BOWLINE

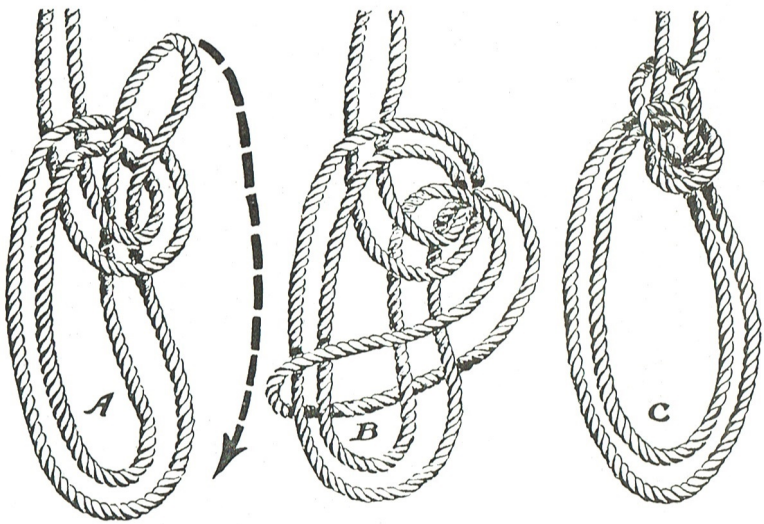
The French bowline is of great value whenever a loop is needed to serve as a boatswain's chair in rescue or other work. Unlike the bowline on a bight, the proportions of the two loops of the finished knot are adjustable. A person may sit in one loop while the other goes around his body leaving his hands and arms free.

Tying: In tying, all that is necessary is to form an ordinary bowline, passing the rope end through the overhand loop once and bringing it back again to make the final knot.

BOWLINE ON A BIGHT

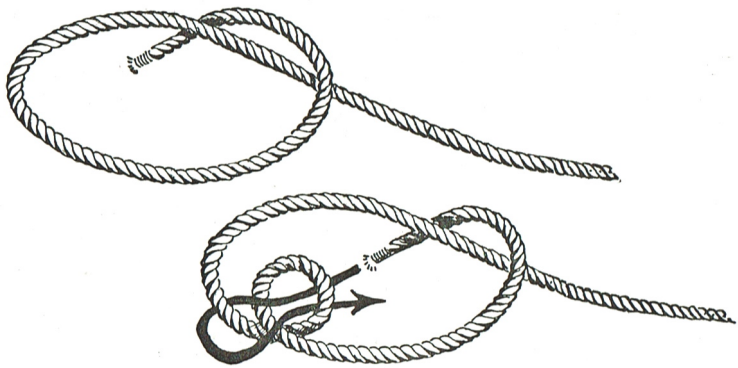
Like the French bowline, this knot is used as a boatswain's chair. It does not leave both hands free, but its twin loops form a more comfortable seat than an ordinary bowline or a French bowline. Occasionally it is used to attach one rope to two others for temporary use. The difference between this knot and the French bowline should be well understood.

Tying: Form a good-sized bight and throw an overhand loop as shown in Fig. A, bringing the end up through the loop so formed. Open the end loop and bring it down and around the entire knot as shown in Fig. B, until it ends up against the standing part as shown in Fig. C. Set the knot securely before putting weight on it.



RUNNING BOWLINE

This method of tying the running bowline is needed in order to avoid leading a long length of rope through the loop of a bowline. It may be started as shown in the top drawing or by making the overhand loop first as shown in the lower drawing. In either case it avoids the slower method of tying a bowline and reversing it over the standing part.

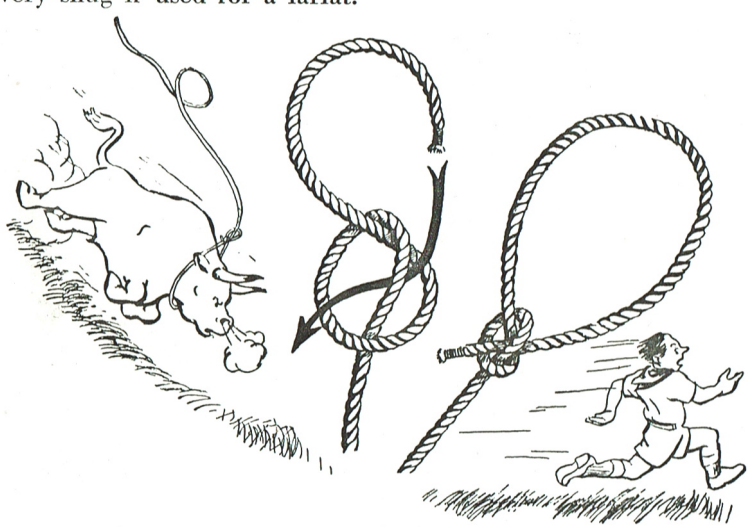


Running Bowline

LARIAT LOOP

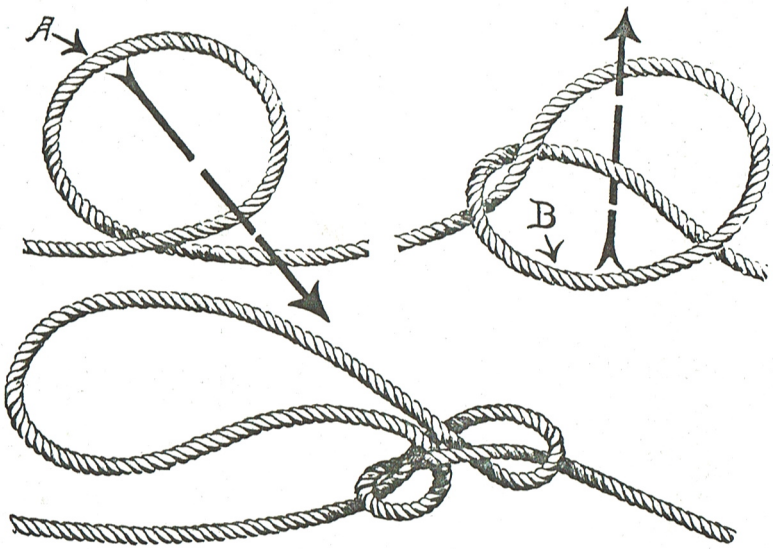
Most lariats have a metal ring or honda spliced into the end, but on a few ranges cowboys use the lariat loop as the running knot in their lariats. It also makes a good tie for cattle and horses because it forms a fixed loop and is easily untied by opening the overhand part.

Tying: The lariat loop consists of nothing more than an overhand knot with the free end brought back as shown in the illustration. It should have a stopper knot (such as the figure-of-eight or double Matthew Walker) in the end and must be pulled—or even hammered—very snug if used for a lariat.

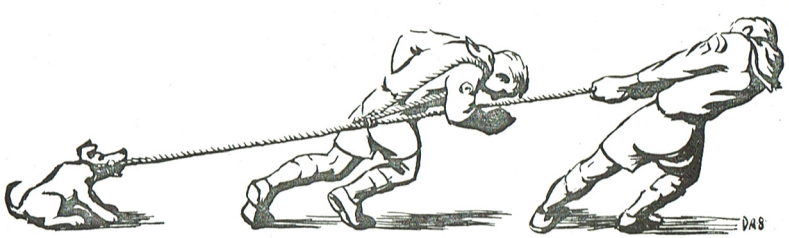


MAN-HARNESS KNOT

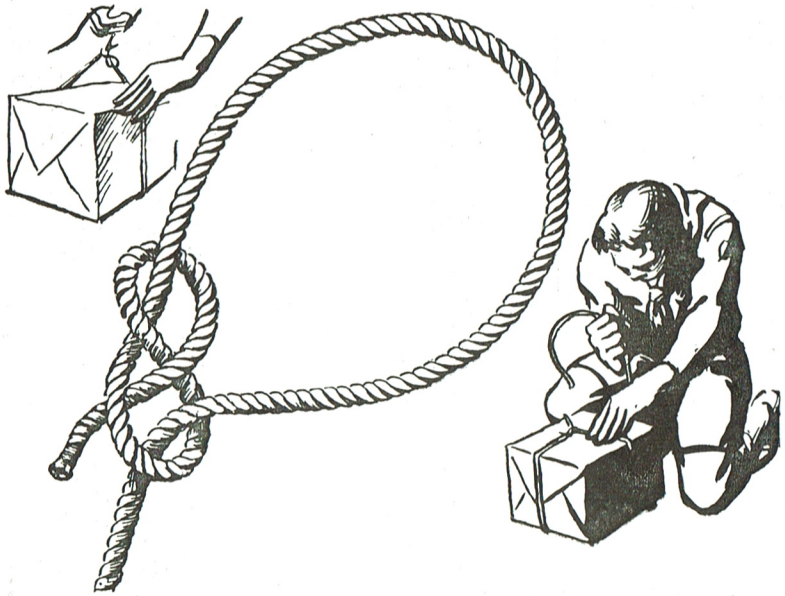
The principal use of this knot, sometimes called the harness knot, is to add man power to a rope that is being used for hauling. It is tied only in the middle of the rope.



Tying: To tie, form an underhand loop as shown in Fig. 1. Grasp the loop at A and lay over the part of rope shown by arrow, resulting in Fig. 2 (A becoming B). Grasp the rope at B in Fig. 2 and draw it up under and over as shown, forming a bight which becomes the loop in the finished knot. Care must be taken, especially with heavy rope, to draw this knot tight before using. It is generally employed by putting the arm through the loop and pulling from the shoulder.



Other Useful Knots and Methods



PACKER'S KNOT

In handling parcel post packages, the post offices constantly have trouble because of poorly or improperly tied boxes and bundles. A great deal of damage and time lost in the mails could be eliminated if more people knew how to make a wrapping secure.

Tying: The packer's knot is one of the best means of beginning to wrap a package firmly. The knot is easy to tie, being a running loop formed by tying a figure-of-eight knot around the standing part (see illustration). The end should emerge parallel to the standing part, as shown. In wrapping boxes or bundles, make the first turn by passing the loop of the packer's knot around the package and pulling it tight.

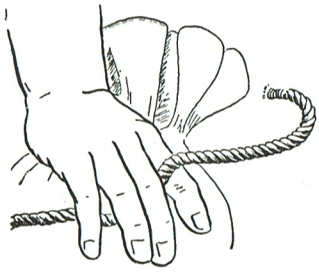


Fig. 1.

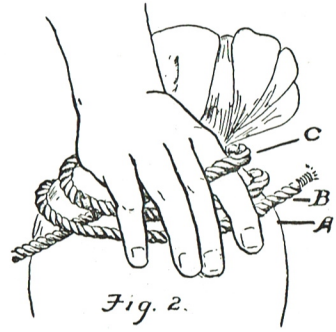
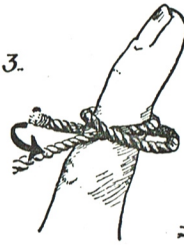


Fig. 2.

Fig. 3.



With forefinger A pull rope end B up under rope C

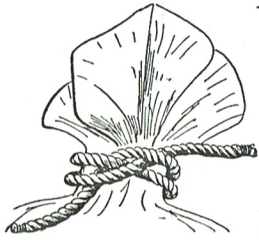


Fig. 4.

Fig 5.

MILLER'S KNOT AND STRANGLE KNOT

These knots are usually tied with string, binder twine, raffia, or heavy cord. Structurally they are very much the same. In the miller's knot (Figs. 1, 2, 3) the end weaves over and under the two turns; in the strangle knot (Fig. 4, 5) the end passes under both turns. The miller's knot is invaluable to campers, hikers, farmers, and all who handle sacks of such things as flour, salt, and grain. The strangle knot has many handy applications and can be tied very quickly. For example, it may be used as an emergency whipping, as a tie for a finger bandage, or as a substitute for the miller's knot.

Tying: The knack of tying the miller's knot depends upon the forefinger. Notice how the first turn in Figures 1 and 2 leads over the forefinger and the others pass under all fingers. In the strangle knot the important point is to cross the second turn over the first (Fig. 4) and to pull the end under both turns. Either of these knots can be made easy to untie by drawing a bight instead of an end underneath.

BARREL SLING

When it is necessary to hoist an open barrel by a derrick or other means this sling is employed. It may be used repeatedly without untying.

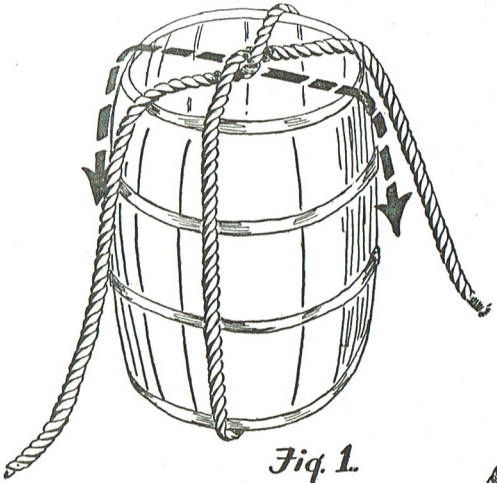


Fig. 1.

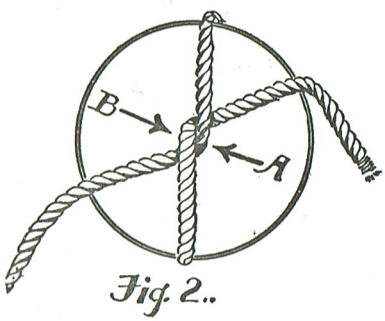
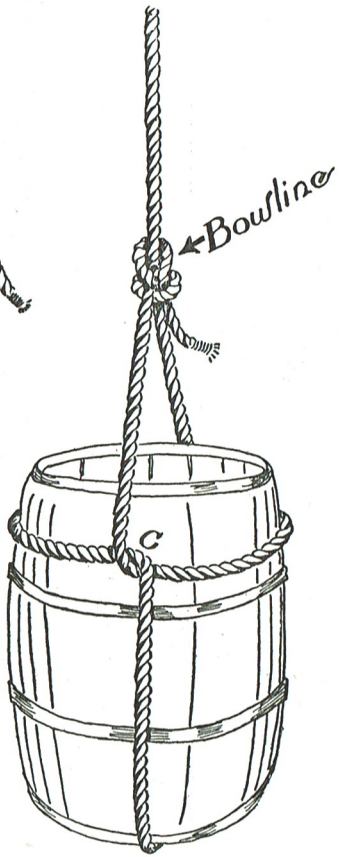
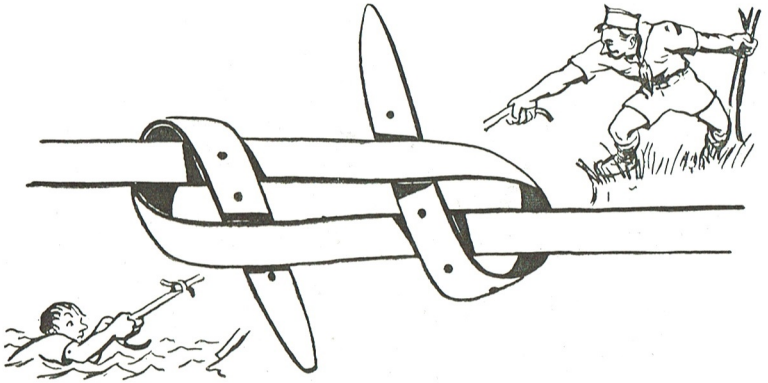


Fig. 2.

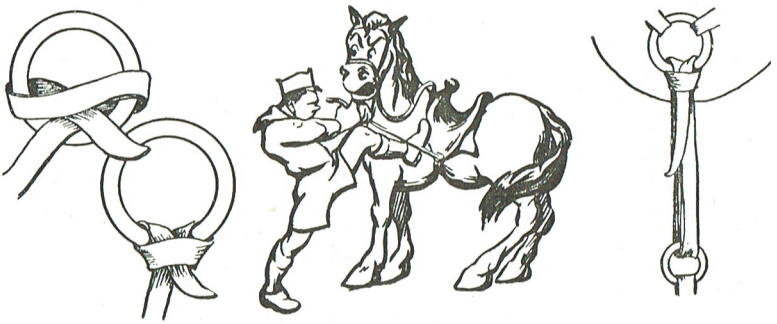


Tying: Lay a length of rope on the ground. Place the barrel on it in an upright position about two and a half times the barrel's height from the end. Bring the rope ends over the top and form an overhand crossing (Fig. 1). Grasp the rope with one hand at A and with the other hand at B (Fig. 2). Pull in opposite directions, opening the knot. Carry the halves down over the sides of the barrel as indicated by the arrows in Fig. 1. If this is done properly the rope-turn shown at C in the final drawing will result on both sides of the barrel. The sling is finished by tying a bowline as indicated. If the sling is to be used on a rather slippery object it is safer to pass two loops about the object.



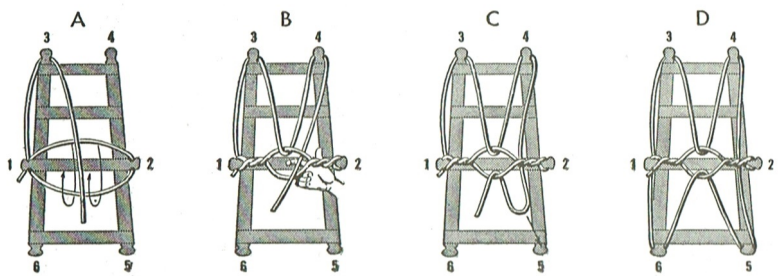
STRAP KNOT

This is a knot designed especially for tying flat leather straps. In several ways it is comparable with the fisherman's knot and the wire splice. It is merely two interlocked loops. With a strap knot, leather straps or belts can be linked together to form an emergency rope.



GIRTH HITCH

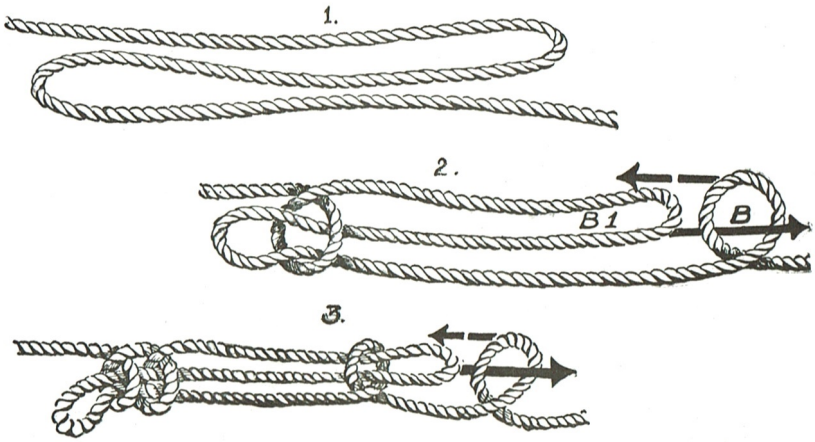
The girth hitch is a handy means of attaching a leather strap or rope to a metal ring. Its only frequent application is in tying the cinch strap of a western saddle, as shown at the right. Tied in the middle of the rope with a toggle it is called a lark's-head. (See page 41.) Also tied without a toggle by passing the end around an object and through the bight, the lark's-head is often used to attach shipping tags and the like.



THE DIAMOND HITCH

The diamond hitch, famous for its use by prospectors, traders, and trappers in loading their pack horses, is also a handy lashing for tying a hiking pack to a six-point frame. The advantage of the diamond hitch is that a tug or a pull on any section of the line results in every other section being drawn tighter. When used for a pack horse, point 1 is usually a ring in one end of the girth and point 2 a hook in the other end. Points 3, 4, 5, and 6 are corners of the pack around which the loops are slung.

Tying: Make one end of the rope fast to knob 1, using a clove hitch. Twist two center strands three times before pulling through bight in Fig. B. Loop the line over the other points in numerical order as shown in the diagrams. Work only with bights in rope. Never pull free end through. When the hitch is nearly complete, pull the rope to tighten all sides of the hitch and tie it on knob 1 (over the starting hitch) with a hitch or knot. Fig. D shows the hitch completed around a pack. Note the "diamond."



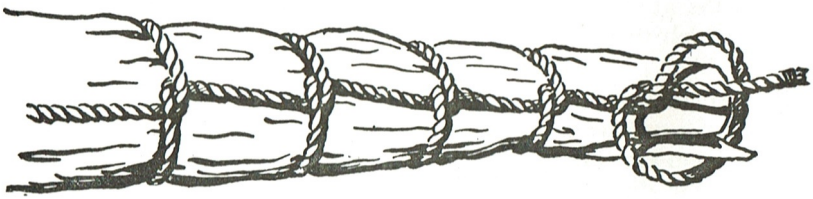
1. First Step. 2. Sheepshank with Single Half Hitches.
3. Sheepshank with Clove Hitches.

SHEEPSHANK

Occasionally there is need for a method of shortening a long rope which is fastened on both ends. The sheepshank answers this need, but it is only a temporary knot unless the eyes are seized to the standing part, a toggle (page 41) is inserted, or a second half hitch (making a clove hitch) is added at each end.

Tying: After taking up the slack as shown in Fig. 1, form an underhand loop as shown in B, slide it over the bight B1, and pull it taut. Do the same on the other end to complete the knot.

MARLING



This is a series of overhand knots used in lashing hammocks or marling down canvas chafing gear on large ropes. The sections which run the long way (in this case horizontal) should always emerge on the under side of the crossings.

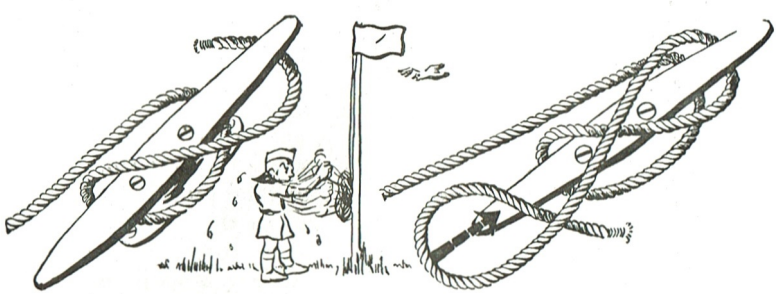
Sheepshank End with Toggle

Lark's-Head with Toggle

TOGGLES

Sometimes a knot must be locked temporarily, perhaps in a rope that suspends a piece of emergency equipment or perhaps, as in the case of the sheepshank, just to make the knot more efficient. For such purposes a small piece of wood, metal, or any other inflexible material is used. Called a toggle, this piece can be inserted in a few specific knots as shown in the illustration. Its value lies in the fact that by withdrawing it the knot can be released instantaneously. Only a slight amount of stress or weight is necessary to keep the toggle in place.

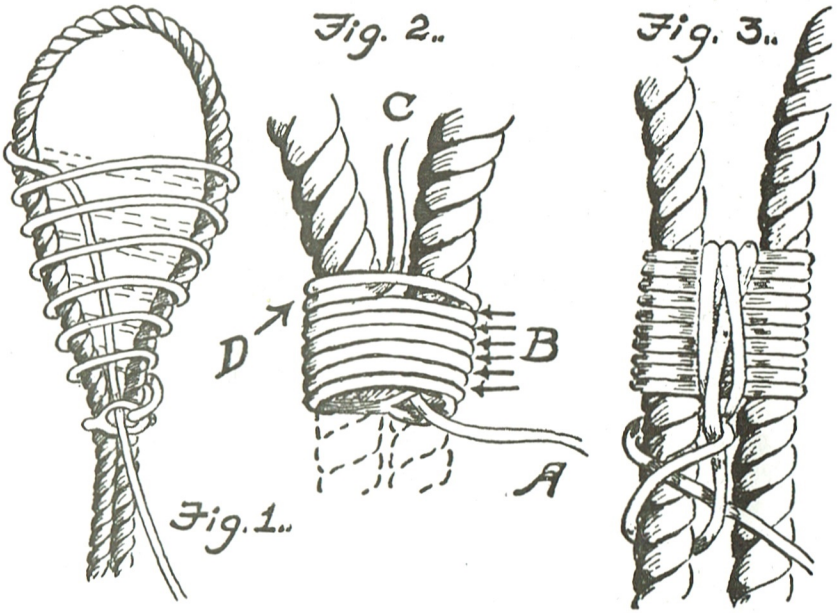
BELAYING



Sailors belay perfectly without conscious effort, but the average landsman does a very poor job of belaying. Too often the latter winds a rope around a cleat endlessly instead of using a few proper tur s. Take just one turn around the cleat as shown in the left-hand drawing. Make one or two figure-eight movements as shown in the right-hand drawing. Finish with a hitch (underhand loop) pulled up snug, unless the rope may need to be loosened in a hurry.

SEIZINGS

Seizings are generally applied only to ropes of the large size used on ships. They either secure two parallel ropes together or form an eye. Seizing is an absolute necessity in connection with the carrick bends. Among many minor forms there are two main types — the round seizing and the racking seizing.



Round Seizing

Bring the bight (or two ropes) together as shown in Fig. 1. Splice an eye in the end of the seizing material (or, if the ropes and seizings are small, use a timber hitch) and take several turns (generally 8 to 10) around both parts as shown. At the finish of the turns bring the end down between the loops and up through the eye. Snug up all the loops until they are as shown in Fig. 2 with the end protruding as shown at A. Take a second series of turns, called riders, over the first, laying the turns in the grooves as shown in B. Do not pull them so tight that they will separate the first series of turns. Finish this set of riders with a tuck-under as shown at D. This will leave the end as shown at C. Take two or three turns (frapping turns) as shown in Fig. 3, forming a clove hitch in so doing. Take the end down onto one of the ropes and fasten with another clove hitch.

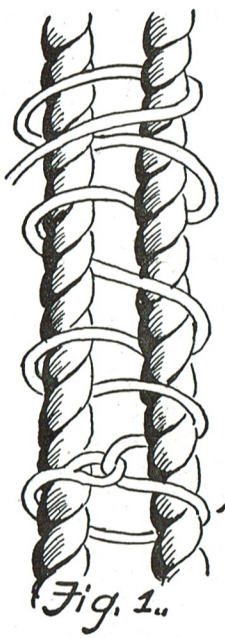


Fig. 1.

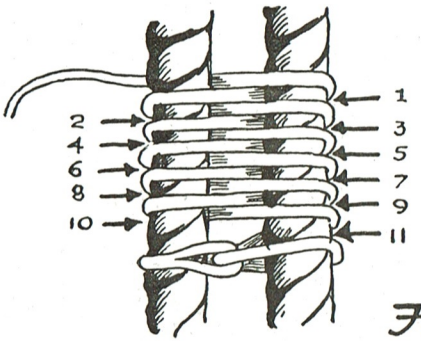


Fig. 2.

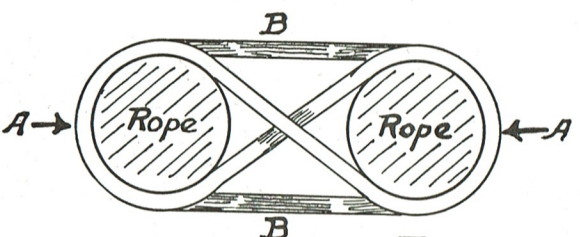
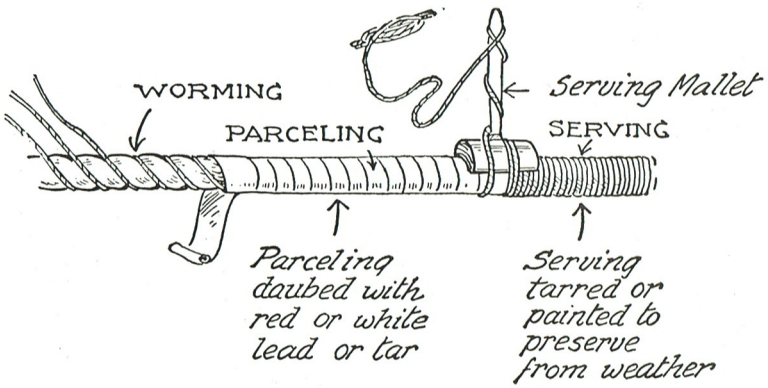


Fig. 3.

Racking Seizing

Racking seizing is used in rigging ropes together when the strain is greater on one rope than the other. Differing from the round seizing, this method uses a figure-of-eight movement of the material around the ropes in the first set of turns. Start with an eye splice as shown in Fig. 1 and make as many turns as are necessary. After this has been accomplished bring the turns together as shown in Fig. 2. Start winding back towards the eye splice, laying the lashing into the spaces between the turns of the first set.

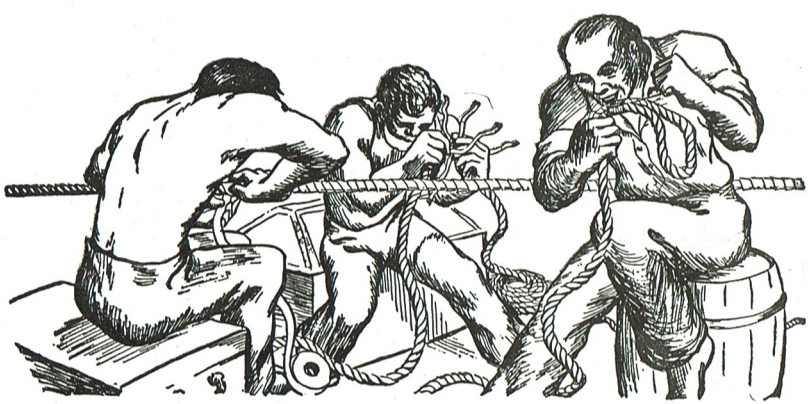
Note that this set of turns goes round and round, fitting into spaces marked in Fig. 2 by 1-2-3-4, etc. When the original starting place has been reached, the seizing may be finished by making the same frapping turns and fastening used for the round seizing. Fig. 3 illustrates the racking seizing in cross section. The figure-eight movement of the first series of turns is shown by the white band and the circular spiral of the second series by the dark.



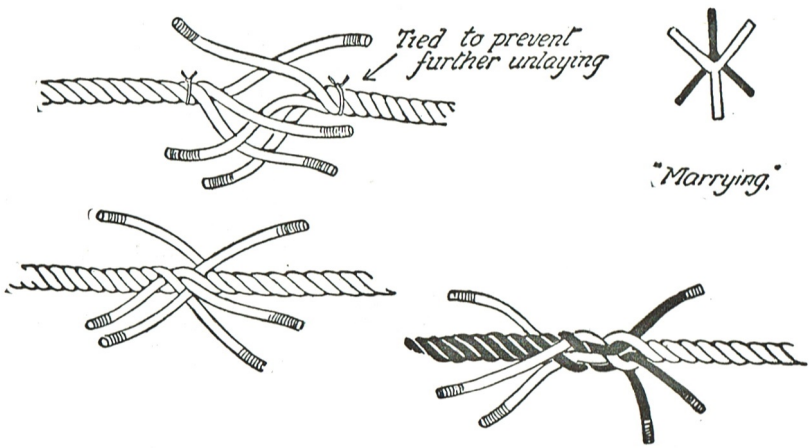
WORMING, PARCELING, AND SERVING

Worming, parceling, and serving are steps in the thoroughgoing old-fashioned method of protecting rope from weather.

Worming consists of laying cord or string of suitable size in the hollows (scores) between the strands of a rope. Parceling is the covering of this with strips of canvas, so placed that they will shed the water like the clapboards on a house. Serving is light rope or cord wound on against the lay and hove taut with a serving mallet or serving board as shown in the sketch. This work should, of course, be done with the rope stretched out.



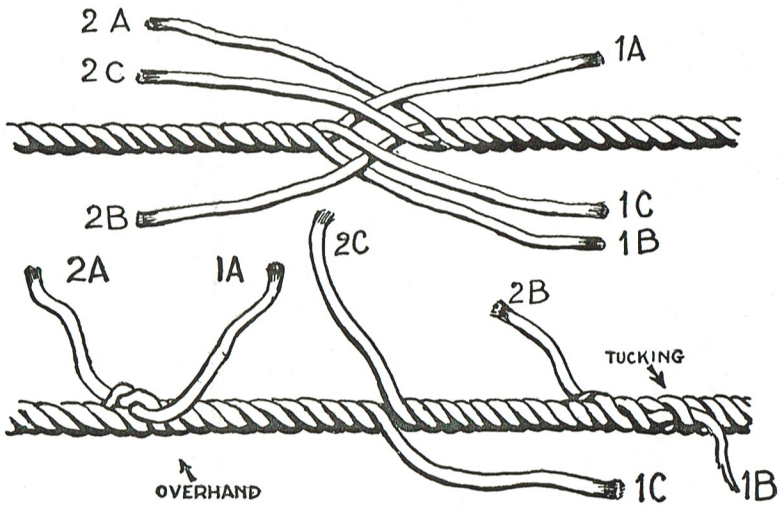
Splices



SHORT SPLICE

When a rope is injured or when two ropes of the same size are to be joined together permanently, this splice is most often used. If the rope is injured, the damaged part is cut out and the sound sections are spliced.

Splicing: Unlay (untwist) the ropes for about four or five turns. Bring the ends together so that the strands of one rope alternate with the strands of the other rope. This is called "marrying." Tuck the strands of the left-hand rope over and under the strands of the right-hand rope; in the same manner, tuck the strands of the right-hand rope over and under the strands of the left-hand rope. If necessary, twist the rope against the lay slightly in order to loosen it enough to tuck in the strands. When each strand has been woven "over and under" twice, stretch the rope taut and trim down the strand ends, cutting in a direction away from the center of the splice. Finally, smooth the splice by rolling it under your foot on the floor.



LONG SPLICE

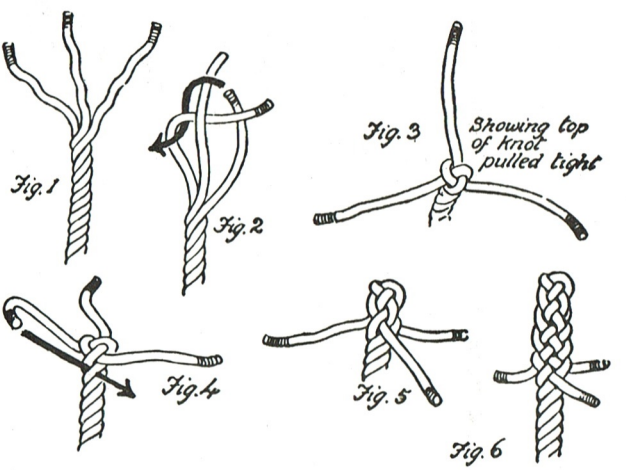
The making of a good long splice is an art. It is used less often than the short splice, and the process of making it requires much more rope. For the latter reason it can seldom be done in practice unless old rope, past its usefulness, is available. When made by a skillful hand the long splice is difficult to detect and will run over the sheaves of a block without any trouble. The ropes to be joined should be the same lay and as nearly the same size as possible.

Splicing: To begin the splice, carefully unlay at least six times the circumference of the rope. (If the rope is to run over a sheave, unlay more than double that amount.) "Marry" the strands, as in the short splice, and hold them in close contact. Unlay strand 1A and fill its former place with strand 2A until only enough of strand 2A remains for the final hitch and tucks. Trim strand 1A down to the same length, and hitch the two strands with an overhand crossing, right to left. Repeat this process exactly the same with strands 1B and 2B. The strands 1C and 2C, now precisely in the middle, are simply tied there with the same hitch used to tie the others. Except for the protruding ends, the rope should now look like one continuous piece.

Tuck the strands over and under once, as is done in the back splice. Cut away about half of the yarn from the under side of each strand and tuck again. Trimming away the yarn gives a taper to the splice. Sometimes the trimming and tucking is done a third time. Then pound the tucks down into the lay of the rope, stretch the rope taut, and clip off the strand ends.

In another method (not illustrated), the strands are not tied with the overhand and the tucking is done *with* the lay, so that strand 1A, for example, would be wound about only strand 2A, instead of weaving under and over all three strands of the rope body. This method of following the lay ("sailmaker's method") is preferred by some experts for all splices.

BACK SPLICE



No length of rope should ever be put into service without having had the end properly prepared. Whipping (see page 8) is one method of preventing fraying and back splicing is another. The back splice is more durable, although not suited to some uses of rope.

Splicing: The ends are first laid over each other in a crown knot (see Figs. 1-3) and protrude from the crown point back along the standing part of the rope. They are tucked as in the short splice (see page 45), with the same over-and-under movement. Trim the ends and smooth the splice by rolling it on the floor with your foot.

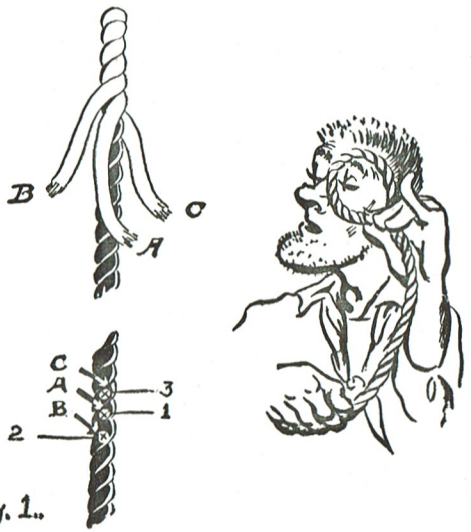


Fig. 1.

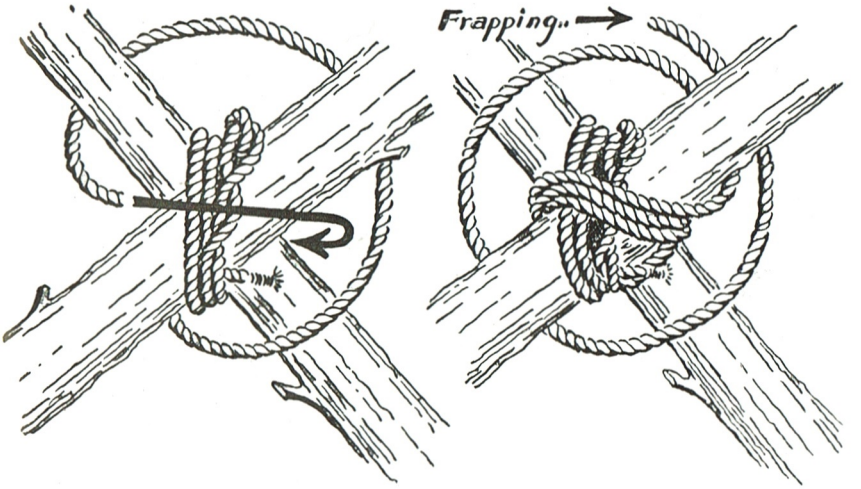
Fig. 2.

EYE SPLICE

The eye splice is called the side splice when used to splice one rope into the side of another. If a permanent loop or eye is needed, no knot can rival the eye splice for neatness and efficiency. Like the short splice, it is woven "one over, one under," and strands may be loosened for tucking by twisting the rope in the direction opposite to the lay.

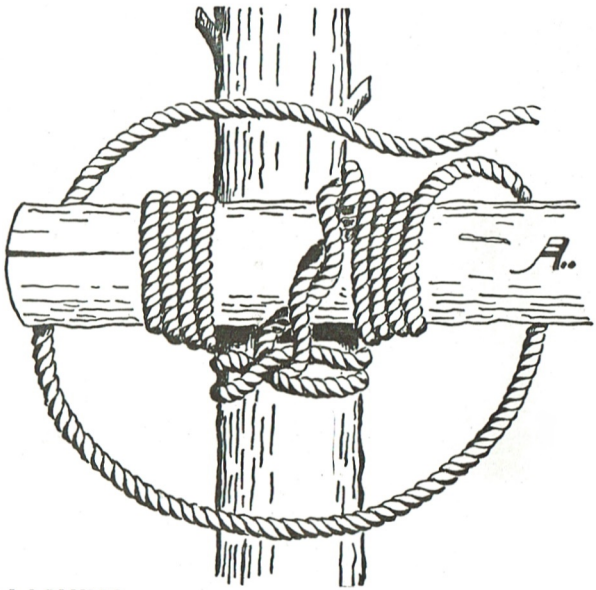
Splicing: Unlay the end of the rope for four or five turns and bring the strands back on the standing part at a distance sufficient to make a loop of the desired size. Lay the three strands of the end along one side of the standing part. Take (A), the middle one of the end strands leading from the top, and tuck it under any near strand (1) of the standing part. Pull it through. Tuck the left strand (C) under the next strand above (3) and tuck the right strand (B) under the next strand below (2). The three end strands should now be woven through three successive standing part strands. Carry each end over the next strand and repeat the tucking once or twice—"one under, one over." Clip the loose ends and roll smooth. (Fig. 1 shows side view of loop. White is the end and dark strands are the standing part.)

Lashings



DIAGONAL LASHING

A diagonal lashing is used to "spring" two spars together, that is, to lash together two spars which tend to spring apart and which do not touch where they cross. The lashing is started with a timber hitch around both spars. The timber hitch is tightened so as to draw the two spars together. Three or four turns of the lashing are then taken around one fork, and three or four turns around the other fork. Two frapping (tightening—see "Round Seizing") turns are taken about the lashing at the point where the spars cross, and the lashing is finished off with a clove hitch around the most convenient spar.

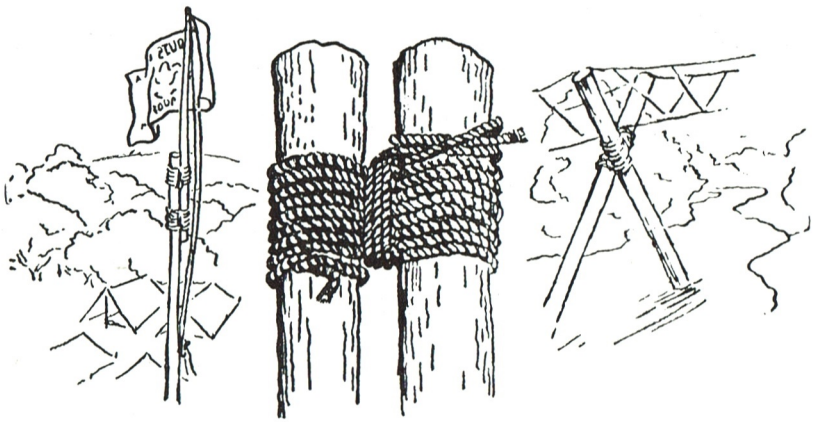


SQUARE LASHING

A square lashing is used whenever spars cross at an angle, touching each other where they cross. The lashing starts with a clove hitch (or timber hitch) around the upright spar immediately below the horizontal spar. After the clove hitch has been forcibly tightened, the free end and the standing part of the rope are then twisted tightly around each other in order to hold the loose end. The lashing is then taken in front of and up over the horizontal spar. It then passes behind the upright spar, down in front of the horizontal spar, and finally around behind the upright spar, just above the original clove hitch.

The process is then repeated four times, keeping outside the previous turns on the horizontal and inside them on the upright. The drawing shows the start of the next step—three or four frapping turns. The lashing is finished by a clove hitch on the horizontal spar (A). This clove hitch must be snugged and slid near the lashing. The lashing is then beaten with a club or pick handle to tighten it.

During the construction of the lashing the turns should be drawn as tight and kept as close as possible. The test of a lashing is neatness and firmness. Slovenly, loose work should not be allowed, even if time is short. Observe this rule—never hurry a lashing.



SHEAR LASHING

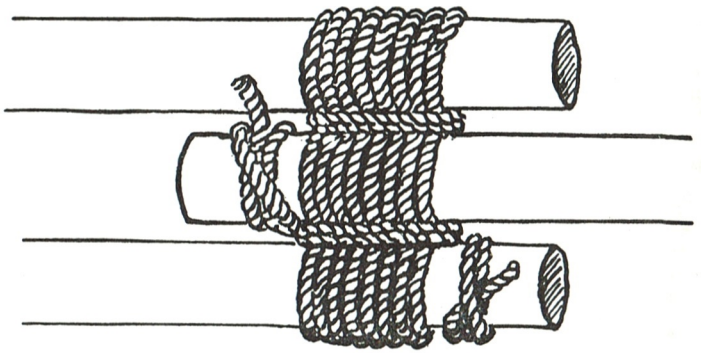
The shear lashing is used for lashing together parallel spars and for forming "shear legs," which support bridges and the like. In general it is very much like a large-scale round seizing, made with logs and rope rather than ropes and cord. Sometimes it is made by an alternate method that more nearly resembles racking seizing.

Lashing: To lash spars which will remain in a parallel position, begin with a clove hitch around one of the spars. Secure the free end by twisting it around the standing part, then take seven or eight turns about both spars. These turns need not be very tight but the frapping turns taken around them should be pulled very snug. Finish with a clove hitch on the spar opposite to that on which the first clove hitch was laid.

The same process is used in lashing spars together for shear legs. The poles are laid parallel until the lashing is finished. The lashing turns are put on very loosely and the frapping turns very tightly. The mass of rope thus pulled between the spars acts as a pivot upon which the shear legs can be spread open in scissor fashion.

Tripods: To lash three spars together in forming a tripod, lay the spars on the ground pointing in alternate directions. Begin with a clove hitch or timber hitch on one of the end spars. Take seven or eight loose lashing turns around all three spars and loose frapping turns in the spaces between. Finish with a clove hitch on the center spar and hoist the tripod into place.

A tripod that will not support heavy weights can be made by another quicker method of lashing. The poles are held in a vertical position and the starting end of the lashing is laid along one of the poles. Wind the lashing from the top downward, binding the first end of the rope against the pole. After three or four turns around the poles, carry the other end up on the outside to the top of the lashing and bring it down underneath the turns. Pull this end down snugly and jam it sideways so that it is held tightly between the lashings and a pole. Spread the lower ends of the spars to form the finished tripod.



Tripod (Shear Lashing Method)

Other Books about Knots

Ashley Book of Knots, Clifford W. Ashley.

Pioneering merit badge pamphlet, *Boy Scout Handbook, Sea Explorer Manual, Seamanship* merit badge pamphlet, Boy Scouts of America.

Handbook of Knots, Raoul Graumont.

Encyclopedia of Knots and Fancy Rope Work, Graumont and Hensel.

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